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(56) Documents Cited
GB 2166128 A US 4278480 A US 4168191 A
US 4098625 A US 4018636 A US 4014720 A
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(54) Abstract Title
Plastic explosive composition

(57) A method for the production of a plastic explosive compound the compound comprising at least a plastic basic composition and a explosive composition, comprises the steps of preforming the plastic basic composition; and combining the plastic basic composition with at least a explosive composition to form a plastic explosive. A plastic explosive comprises at least a plastic basic composition, ceresine and an explosive plastic compound. The plastic basic composition comprises oil and a polymer, in the ratio 15-95% w/w oil and 5-85% w/w polymer.

GB 2 326 408

PLASTIC EXPLOSIVE

The invention relates to a method for producing a plastic explosive composition ISD. A plastic explosive composition ISD is intended for use in industry and military for demolition, obtaining a new property of the materials, hardening, cutting, hydroexplosion of the metals.

For a plastic explosive composition C1, C2, C3, C4, see U.S. Patents: 3,147,163, 4,014,719, 4,014,720, 4,018,636, 4,054,900, 4,098,625, 4,168,191, 4,278,480 and 4,549,900. MIL-C-45010A/MU/ comprising the wax, petroleum jelly, paraffin, machine oils polyisobutylene and hexogen. Plastic explosive composition consist polyisobutylene, dioctyl sebacate, mass polypropylene, see Japan Patent 50-1190. The explosive compositions obtained are plastic composition and explosive plastic composition together.

According to the present invention there is provided a plastic basic composition which is characterised that mixing, homogenising, plasticizing with hexogen RDX or other explosive plastic compound, is obtained a stable plastic explosive substance under periodic variable the climates effects no less 10 years and stay under water no less 4 weeks and detonator initiation at blasting cap 8A having stable detonation, the typical velocity of detonation is 7300-7500 m/s at density 1.35 g/cm^3.

When the plastic basic composition is present in an amount of 40% by weight of the total composition, the hexogen or other explosive plastic compound is present in an amount of 60% by weight of the total composition, when the plastic basic composition is present in an amount of 25% be weight of the total composition, the hexogen or other explosive plastic compound is present in an amount of 75% by weight of the total composition.

Such a composition can be made by a method for producing a plastic basic composition comprising the steps of forming a mixture of the oils: petroleum oil with the aromatic, naphthene hydrocarbons having alicyclic unsaturated hydrocarbons comprising

5,6 member the hydrocarbon rings with freezing temperature no higher minus 40C and a kinematic viscosity at plus 40C is 17-36 mm^2/s or the naphthene-aromatic oils or the synthetic polyphenyl oils comprising in the molecules 4,6 benzol rings with freezing temperature no higher minus 50 °C, kinematic viscosity at plus 50C is 17-20 mm^2/s or mixture of both kind the oils and the atactic polypropylene with softening temperature 130-150 °C, and the ceresine with melting point no less 75 °C, penetration at plus 25 °C is 10-16.

According to a further aspect to the invention there is provided a method for producing a plastic basis composition to obtain a amorphocrystalline structure through is heated the oil, adding into heated oil the portions of the atactic polypropylene in advance cutting a dosing, stirring, keeping temperature 133-137°C to obtain dissolution of 80-85% by weight of atactic polypropylene and the temperature is raised on 190-200C, stirring is continued to obtain a clear solution or separated insoluble part of atactic polypropylene and added into heated to 190-200 °C the same oil stirring to obtain a clear solution and is added into the basis composition, stirring to obtain a clear solution. The ceresine is added the portions, the temperature is reduced to 155-130 °C, stirring is continued to obtain a clear solution. The solution is discharged in the vessels and stay minimum 48 hours.

On a percent by weight basis the oil phase may be between 15-50% of the total composition weight. The atactic polypropylene may vary between 5-50% of the total composition weight the ceresine is present of 30-35% by the total composition weight.

According to a further aspect of the invention the plastic basis composition is modified by: aluminium powder, starch, ferrosilicon powder, calcium stearate, oleic acid, glycerine, pentaerythritol, citric acid, the side product from produce: a citric acid, sugar, food yeast, wine, beer, and is treated by ozone-oxygen mixture.

The preferred ranges using the above system of determining percentage amounts are 1-5% aluminium powder, ferrosilicon powder, 5-15% starch, 1-3% glycerine, 0.5-1%

calcium stearate, 0.3-0.8% oleic acid, 3-10% pentaerythritol, 5-35% side product from produce: sugar, citric acid, food yeast, wine and beer.

The following examples wherein the concentration are expressed in parts by weight of the total composition will serve to illustrate the invention.

1. Plastic basis composition

Example 1

formula:

39.5 p. Petroleum oil/aromatic, naphthene-aromatic/

21.5 p. Atactic polypropylene

39.0 p. Ceresine

The petroleum oil is added to a mixer and heated to 160 °C and adding into heating oil the portions in advance cutting, dosing atactic polypropylene, stirring, upkeeping temperature at 133-137 °C an d the medium to obtain dissolution of 80-85% by weight of atactic polypropylene. The temperature is raised of 190-200 °C the stirring is continued to obtain a clear solution. Into a clear solution are added the portions the hard ceresine in advance cutting, dosing. The temperature is reduced to 125-130 °C. Stirring is continued to obtain a clear solution, discharged in the vessels, stay minimum 48 hours.

The plastic basis composition prepared by this method had the following properties:

Melting point 83 °C

Penetration at 25 °C cone 47

Penetration at minus 40 °C

cone 23

needle 30

Explosive plastic composition, mixture between plastic basic composition and hexogen ratio 25/75:

sensitive to a 8A cap

velocity of detonation 7430 m/s

Example 2

A method according example 1, wherein after dissolution of 80-85% by weight of the atactic polypropylene insoluble part is separated and heated to 190-200 °C into the same oil, stirring is continued to the full dissolution adding in the basis composition mixing to obtain a clear solution. The plastic composition by this method had he following properties:

Melting point 94 °C

Penetration at 25 ºC cone 43

Penetration at minus 40 °C

cone 18

needle 60

Explosive plastic composition, mixture between plastic basis composition and hexogen ratio 25/75:

sensitive to a 8A cap

velocity of detonation 7540 m/s

Example 3

A method according example 1 wherein after dissolution of atactic polypropylene is added the ceresine is melted in advance and mixing to obtain a clear solution. The plastic composition by this method had the following properties:

Melting point 74 °C

Penetration at 25 °C cone 50

Penetration at minus 40 °C

cone 9

needle 53

Explosive plastic composition mixture between plastic basis composition and hexogen ratio 25/75:

sensitive to a 8A cup

velocity of detonation 7380 m/s

Example 4

A method according example 2 wherein the petroleum oil is changed with the synthetic polyphenyl oil.

formula:

37 p. Synthetic oil/polyphenyl/

24 p. Atactic polypropylene

39.p. Ceresine

The plastic basis composition prepared by this method had the following properties

Melting point 97 °C

Penetration at 25 °C cone 35

Penetration at minus 40 °C

cone 38

needle 67

Explosive plastic composition, mixture between plastic basis composition and hexogen ratio 25/75:

sensitive to a 8A cap

velocity of detonation 7640 m/s

2. Modification of the plastic basis composition. The plastic basis composition is melted 20-25 °C over melting point adding modifying component, mixing is continued until a limited viscosity is achieved.

Polyphenyl oils include aromatic esters containing 4 to 6 carbon molecules with the ester bonding at the m position.

According to a further aspect of this invention, there is provided a method for producing a plastic explosive composition ISD wherein the plastic basis composition is added into a conventional Z blade mixer with two-shaft horizontal mixer is heated composition to 90-110C. The stirring continue to obtain a clear solution. The Hexogen or Octogen or PENT in advance dispersing and dosing is added of portion into solution. The mixing, kneading continue to homogenising composition. The temperature reducing to 50-60 °C, discharging, stay at 25-30C, 1-2 hours and again kneading, plasticizing, discharging at temperature 25-35 °C the same mixer to obtain a dough or putting like consistency mass.

According to a further aspect a method for producing a plastic explosive composition ISD wherein the plastic basis composition IS / application in advance dosing is added into Melting - Casting Vessels and heating plastic composition to 95-110 °C to obtain a clear solution. The Hexogen or Octogen or PENT in advance dispersing, dosing is added of portion into the solution. The stirring continue to homogenising composition. Discharging into the flat vessels, stay at temperature 25-30C cutting the hard mass composition. Adding this mass into Z Blade Mixer with two-shaft horizontal mixer at temperature 25-35 °C, kneading, plasticizing to obtain a dough or putty-like consistency mass, discharging.

According to a further aspect of the invention there is provided a method for continuous producing a plastic explosive composition ISD using The CONTERNA of Messrs - PROPEX RESEARCH ENGINEERING GERMANY. The plastic basis composition IS in advance melted at temperature 20-25 °C over melting point of plastic

basis composition to obtain a clear solution. Adding in the first chamber of machine the clear solution and Hexogen or Octogen or PENT in advance dispersing, continually dosing in definite weight ratio. The six chambers are heated to temperature 95-110 °C and the next six kneading chambers are cooled to temperature 60-30 °C. The kneading, pumping, conveying tools and twin screw extruder are kneading, homogenising, dispersing, plasticizing, convening and discharging the plastic explosive composition ISD.

On a percent by weight basis, the plastic basis composition IS may be between 5-40% of the total composition weight. The Hexogen or Octogen or PENT may vary between 60-95% of the total composition weight. The preferred discovering substance: ethylene glycol dinitrate or 2,3 dimethyl, 2,3 dinitrabutane 0.1% by weight of the total composition.

The advantages this invention are: separated producing a plastic basic composition IS and plastic explosive composition ISD wherein the method producing obtained amorphocrystalline structure of the explosive composition. The plastic composition has positive participation detonation. The plastic explosive composition SD is stable and variable the climate effects: heating, cooling, rain hoar frost, snow, solar radiation no less 10 years, stay under water no less 4 weeks. Detonable at plus 20°C, at plus 50°C, at minus 40°C, and under a water with an 8A cap. The separate producing make more safety and independent the manufacturing processes.

The following examples wherein the concentration are expressed in parts by weight of the total composition will serve to illustrate the invention.

Example 5

Formulae

25.0.p. Plastic basis composition

IS/application.....example 1/

75.0.p. Hexogen/sieve oversize internal dimension 0.161/0.185 mm 94% passing 6%/

The plastic basis composition IS in advance dosing is added into Heavy Duty Z Blade Mixer with discharge screw, heating composition to 105°C to obtain a clear solution. The Hexogen in advance dosing is added of portion into solution. The conventional Z Blade Mixer with two shaft horizontal mixer, mixing and kneading continue to homogenizing composition. The temperature of composition is reduced to 50-60°C to obtain a dough consistency. The composition is discharged, stay 1-2 hours at temperature 25-30°C. After stay the plastic explosive is kneaded, homogenised, plasticised and discharged the same mixer.

The plastic explosive composition ISD prepared by this method had the following properties:

Density 1.39 g/cm^3

Detonable in 4.5 mm with an 8A cap

Velocity of detonation: at the first year 7500 m.s, at the ten year 7500 m/s

Detonable at plus 20C, at plus 50C, at minus 40, into water with an 8A cap.

Excellent water resistance

Not sensitive at coup, rub, shooting of the lead

Plasticity at temperature plus 20C and pressure 0.25 kgf/cm^2 is 45 percent

Plasticity at temperature plus 50C and pressure 0.05 kgf/cm^2 is 63 percent

Plasticity at temperature minus 40°C and pressure 0.7 kgf/cm^2 is 1.3 percent

Adhesion property

Exudation: not explosive oil is 0.44 percent at 55C, period 6 hours

Example 6

Formula

24.0p. Plastic basis composition

IS/application.....claim 8/, plastic basic composition

21.3p., 2.5 p. Starch, 0.7p. Aluminium powder

76.0 p. Hexogen/sieve oversize internal dimension 0.161/0.185 mm is 94% and passing 6%/

The plastic basis composition IS in advance dosing is added into Melting-Casting Vessels, heating plastic composition to 110C, stirring to - obtain a putty like consistency. The Hexogen in advance dosing is added of portion into the melting composition, stirring continue to homogenising of composition, discharged into a flat vessels, stay 6 hours at temperature 20-30C, cutting the hard mass composition, adding into HKS HEAVY DUTY Z BLADE MIXER at temperature 25-35°C, is kneaded homogenised, plasticized to obtain a dough mass and discharged.

The plastic explosive composition ISD prepared by this method had the following properties:

Density 1.44 g/cm^3

Detonable in 3.4 mm with an 8A cap

Velocity of detonation: at the first year 7500 m/s, at the ten year 7500 m/s

Detonable at plus 20C, at plus 50C, at minus 40C, into water with an 8A cap

Excellent water resistance

Not sensitive at coup, rub, shooting of the lead

Plasticity at temperature plus 20°C and pressure 0.25 kgf/cm^2 is 7 percent

Plasticity at temperature plus 50°C and pressure 0.05 kgf/cm^2 is 36 percent

Plasticity at temperature minus 40°C and pressure 0.7 kgf/cm^2 is 0.41 percent

Adhesion property

Exudation: not explosive oil is 0.43 percent at 55°C, period 6 hours

Example 7

The plastic basis composition IS in advance melted at temperature 20-25°C over melting point the composition to obtain a clear solution continually dosing weight ratio with Hexogen is added into the first chamber of machine CONTERNA. The six kneading chamber are heated to temperature 110°C and next six kneading chamber and Discharge Module are cooled to temperature 60-30°C . The kneading, pumping, conveying tools and twin screw extruder are kneading, homogenising, dispersing, plasticizing, conveying and discharge the plastic explosive composition ISD.

Formula

15.0 p. Plastic basis composition/application.....example 3/

85.0 p Hexogen / 4 parts coarse to 1 part fine

Properties: detonable with an 8 cap, velocity 7650 m/s

Formula

9.0 p Plastic basis composition IS

91.0p. Hexogen/3 part coarse to 1 part fine/

Properties: detonable with 8 cap, velocity of detonation

7800 m/s

Formula

5.0 p. Plastic basis composition 1

95.0 p. Hexogen/3 part course to 1 part fine/

For pressing into Demolition Block

Intended use of the invention

This invention is intended for use in industry and military explosives. The plastic explosives composition ISD producing in ratio: Plastic basic composition IS and Hexogen or Octogen or PENT in next version 40:60 /25:75/20:80 /15:85/ 9:91/5:95/.

They are intended for open explosive work through hand made form the charges or pressing into block and charging into body. Plastic explosive composition are not used in a pit without ventilation. Initiation with an 8A cap or higher charge.

According to an alternative embodiment of the invention, there is provided a bonding basic composition which is characterized that mixing, homogenising, plasticizing with ceresine and hexogen RDX or other explosive plastic compound, is obtained a stable plastic explosive substance under periodic variable the climates effects no less 10 years and stay under water no less 4 weeks and detonation at blasting cap 8A having stable detonation, the typical velocity of detonation is 7300-7500 m/s at density 1.35 g/cm^3. The plastic explosive is a stable under periodic sharp change temperature from -+ 40 °C to -50 °C, solar radiation, static electricity, low sensitivity of an impact and a friction. The plastic explosive has got adhesion properties and do not emits gas fluorine, compounds when it is employed.

The plastic explosives are produced like a plasticine mass which can take different forms through hand shaping or a putty like mass which can take form block, slab or cylinder by suitable mechanical presses. The bonding basic composition with chemically and physically compatible plasticisers, extenders and tackifiers in the form elastomeric matrix for explosives and smoke screening systems.

When the bonding basic composition one or more kinds composition is present in an amount of 1.7.7% by weight of the total composition, the ceresine is present in an amount of 4-95% by weight of the total composition, the hexogen RDX or other explosive plastic compound or octogen or PENT is present is present in an amount of 60.95% by weight of the total composition.

The bonding basic composition can be made by a method for producing a composition wherein the oil thermostable and low freezing temperature, contain naphthene aromatic hydrocarbons having alicyclic unsaturated hydrocarbon rings or

aromatic, polyphenyl hydrocarbons or mixture of them is mixed and dissolution the atactic polypropylene. The oil in advance dosing is heated over the softening temperature of the atactic polypropylene. The atactic polypropylene is added into heating oil the portions in advance cutting, dosing. Upkeeping the same temperature of the medium, stirring to dissolutions the atactic polypropylene. The insoluble part is separated and heated into the same oil, increasing temperature and stirring to the full melting and dissolution is added into the first solution, stirring to the full homogenisation, discharge in a vessel.

On a percent by weight bonding basic composition the oil phase may be between 15-95% of the total composition weight. the atactic polypropylene may vary between 5-85% of the total composition weight.

The following examples wherein the concentration are express in parts by weight of the total composition will serve to illustrate the invention.

Example 8

	Bonding basis composition						
	A	B	C	D	E	F	G
1 . Oil, %	50	15	80	20	90	30	70
2. Atactic polypropylene, %	50	85	20	80	10	70	30

The naphthene aromatic oil with freezing temperature no higher minus 40 C and fire point in open pot of 170 °C and a kinematic viscosity at plus 40 °C is 17-36mm 2/s is added to a mixer and heated to 160 °C and adding into heating oil the portions in advance cutting, dosing atactic polypropylene with softening temperature 135 C, upkeeping temperature at 133-137 °C, stirring to obtain dissolution of 80-85% by eight of atactic polypropylene. the insoluble part is separated and the temperature is raised of 190-

200°C, the stirring is continued to obtain a full solution and it is added into the first solution, stirring to the full homogenisation, discharge in a vessel.

According to a further aspect of this invention, there is provided a method for producing a plastic explosive composition wherein one or more kinds the bonding basis composition in advance dosing is heated over the melting temperature of the ceresine, adding the ceresine into bonding composition, keeping the same temperature, stirring to obtain a full solution, adding the Hexogen, or Octogen or Pent or other explosive plastic compound advance dosing and dispersing or dispersing next stage of the production, of the portion into the solution, mixing, kneading to full homogenising of composition, fall the temperature continue kneading, plasticizing to obtain a putty like mass or a plasticine consistency mass, discharging at ambient temperature, when the mass obtain ambient temperature it is kneaded, homogenised, plasticized again to obtain a putty like mass or a plasticine consistency mass.

According to a further aspect of this invention, there is provided a method for continuous producing a plastic explosive wherein the ceresine dosing is melted, added into the melting bonding basis composition, homogenising, continually dosing weight ration with Hexogon or Octogen or Pent where at the first stage continually mixing, kneading, dispersing, homogenising at the temperature melting point of the ceresine and the second stage continually kneading, homogenising, plasticizing and discharging at the ambient temperature to obtain a putty like mass or a plasticine consistency mass.

On a percent by weight basis the bonding basic composition one or more kinds composition may be between 1-7 7% by weight of the total composition, the ceresine may be between 4-95% by weight of the total composition may be between 1-7 7% by weight of the total composition, the ceresine may be between 4- 95% by weight of the total composition, the hexogen RDX or other explosive plastic compound or octogen or Pent may vary between 60-95% of the total composition weight.

The following examples wherein the concentration are expressed in parts by the total composition will serve to illustrate the invention.

Example 9

	PLASTIC EXPLOSIVES				
	1	2	3	4	5
Bonding Composition					
A%	-	-	2,0	4.0	1,0
B%					
C%	7.7	-	-	-	-
D%	7.7	-	-	-	-
E%	-	-	-	-	-
F%	-	7.7	7.7	-	-
G%	-	7.7	-	-	-
Ceresine %	9.6	4.6	5.3	6.0	4.0
Hexogen %	75.0	80.9	85.0	90.0	95.0

CLAIMS

1 A method for the production of a plastic explosive compound, the compound comprising at least a plastic basic composition and an explosive composition, comprising the steps of;

a Preforming the plastic basic composition; and

b Combining the plastic basic composition with at least an explosive composition to form a plastic explosive.

2 A method according to claim 1, wherein the plastic basic composition comprises oil and a polymer, in the ratio 15-95% w/w oil and 5-85% w/w polymer.

3 A method according to claim 2, wherein the polymer is polypropylene

4 A method according to claim 2 or 3, wherein the oil is an aromatic naphthene hydrocarbon having alicyclic unsaturated hydrocarbons comprising 5, 6 member or synthetic polyphenyl oils comprising 4, 6 benzol rings, or both.

5 A method according to any preceding claim, wherein the plastic basic composition is combined with an explosive compound and ceresine to form a plastic explosive.

6 A method according to claim 5, comprising the steps of;

a heating the plastic basic composition to a temperature greater than the melting temperature of ceresine

b adding the ceresine into the plastic basic composition at this temperature with stirring

c addition of an explosive compound with stirring

d mixing the composition to homogeneity

e reducing the temperature with continued kneading to obtain a putty like mass at ambient temperature

7 A method according to claim 6, wherein the ceresine is pre-melted before addition to the plastic basic composition.

8 A method according to any of claims 1 to 5, wherein the plastic basic composition additionally comprises ceresine.

9 A method according to any preceding claim, wherein the explosive compound is Hexagen, Octogen or PENT.

10 A plastic explosive comprising at least a plastic basic composition, ceresine and an explosive plastic compound, characterised in that the plastic basic composition comprises oil and a polymer, in the ratio 15-95% w/w oil and 5-85% w/w polymer.

11 An explosive according to claim 10, wherein the polymer is polypropylene.

12 An explosive according to claims 10 or 11, wherein the oil is either an aromatic naphthene hydrocarbon having alicyclic unsaturated hydrocarbons comprising 5, 6 member or synthetic polyphenyl oils comprising 4, 6 benzol rings, or both.

13 An explosive according to claims 10 to 12, wherein the plastic explosive is composed of 1-7.7% plastic basic composition, 4- 95% ceresine and 60-95% explosive plastic compound.

14 An explosive according to any of claims 10-13, wherein the explosive may be stably stored for at least 10 years, or for 4 weeks under water.

15 An explosive according to any of claims 10-14, wherein the explosive additionally comprises aluminium powder in the amount 1-5% by weight of the total composition.

16 An explosive according to any of claims 10-15, wherein the explosive additionally comprises starch in the amount of 5-15% w/w of the total composition.

The Patent Office

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Application N : GB 9812996.8
Claims searched: 1 to 9

Examiner: Michael Conlon
Date of search: 17 September 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): C1D (D6BZ)

Int Cl (Ed.6): C06B

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	US4278480	(Johannes) Example II	1 to 9
X	US4168191	(Benziger) column 4 lines 38 to 51	1 to 9
X	US4098625	(French) column 1 line 63 to column 2 line 17	1 to 9
X	US4018636	(O'Neill) Example 1	1 to 9
X	US4014720	(Wells) Example 1	1 to 9
X	US4014719	(Wells) column 3 lines 17 to 34	1 to 9
X	GB2166128	(Bullock) page 1 lines 40 to 58	1 to 9

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.